Tea 21 goes on to require that all federal funds -- that is, all funds from the Highway Trust Fund under any program -- for ITS projects must confirm to the national architecture and all standards or provisional standards developed under the ITS subtitle. Again, US DOT may waive this requirement under certain conditions for research programs and ITS legacy systems

Last, TEA 21 addresses the allocation of frequency spectrum for ITS purposes. Generally speaking, the Federal Communications Commission (FCC) must consider frequency needs for DSRC and other ITS purposes. More specifically, however, the FCC is directed to complete a rulemaking on allocating spectrum for ITS purposes no later than January 1, 2000. Note: Without saying so, this last point refers to the current ITS America petition before the FCC for spectrum allocation at the 5.8 Ghz Band. (On June 30, 1998, the FCC released its Notice of Proposed Rulemaking to allocate this spectrum for ITS applications.)

Research and Development (Section 5207)

TEA 21 contains a comprehensive ITS research, development, operational test and demonstration program for intelligent vehicles and intelligent infrastructure systems. The program is to give priority for federal funding across five areas:

1. traffic management, toll collection traveler information or traffic control systems;
2. crash-avoidance and integration of in-vehicle crash protection technologies;
3. human factors research
4. integration of intelligent infrastructure, vehicle and control technologies; and
5. impact of ITS on environmental, weather and natural conditions.

ITS operational tests shall be designed to collect data to permit the objective evaluation of the test results and realize cost-benefit information. The federal share for operational tests and demonstration programs is not to exceed 80%.

Intelligent Transportation System Integration Program (Section 5208)

This is the new "deployment incentives" program advocated by FHWA and ITS America. This program requires that US DOT undertake a "comprehensive program to accelerate the integration and interoperability of ITS in metropolitan and rural areas. (The CVO deployment program is described below.) Through competitive bidding, the Secretary is to select projects that improve transportation efficiency, promote safety (including freight movement), increase traffic flow (including intermodal traffic at ports), reduce emissions or promote tourism.

The Secretary shall give priority to deployment projects that:

1. contribute to national ITS deployment goals and objectives;
2. demonstrate a strong commitment to cooperation among agencies, jurisdictions and the private sector
3. encourage private sector involvement and financial commitment;
4. demonstrate a commitment to a comprehensive plan of fully integrated ITS;
5. are part of approved statewide and metropolitan planning processes and air quality plans;
6. minimize federal contributions;
7. ensure long-term operations and maintenance without federal funds;
8. demonstrate technical capacity for effective operations and maintenance;
9. mitigate adverse impacts on bicycle and pedestrian safety; or
10. in rural areas, meet other criteria for safety, geographic and regional diversity or economic development.

Projects in metropolitan areas are to be used primarily to integrate ITS infrastructure elements that are either deployed or to be deployed with other sources of funds. In rural areas, deployment funds are to be spent for the installation of intelligent transportation infrastructure elements.

There are, however, certain limits on how much funding can go to a single area and how it can be spent. In any fiscal year, not more than $15 million may be spent in one metropolitan area; not more than $2 million in a one rural area; and not more than $35 million in one state. Moreover, at least 10% of the funds authorized under this program must be spent on ITS deployment in rural areas. The federal share payable from ITS program funding is not to exceed 50%. However, the total federal share (ITS plus other federal-aid funds) may go as high as 80%.

Note: The two earmarks for the Gary-Chicago-Milwaukee Corridor and the I-95 Corridor appear in this section.

Commercial Vehicle ITS Infrastructure Deployment (Section 5209)

This is the second part of the new "deployment incentives" program for ITS in TEA 21 and is funded at approximately one-quarter of the metro/rural deployment program described above. The CVO deployment program's purpose to is advance the technical capability of ITS applications for CVO while promoting deployment across the country. These ITS/CVO systems should improve safety and productivity of commercial vehicles and drivers, and reduce CVO administrative costs and regulatory requirements.

This program should give priority to projects that:

1. encourage multi-state cooperation and corridor development;
2. improve safety and operations and increase efficiency of regulatory inspection process;
3. advance electronic processing of commercial vehicle data and promote communication of date among the states; or
4. enhance the safe passage of commercial vehicles within the United States and across international borders.

Similar to the metro/rural deployment program, federal ITS funds shall not exceed 50%; total of federal funds limited to no more than 80%. Also, to the maximum extent possible, federal funds are to be used for activities not carried out by private funds and shall be leveraged with non-federal funds.

Use of Funds (Section 5210)

This section places certain general restrictions on how ITS funding can be used. First, there is a $5 million annual limit for outreach and public relations activities. (Training and the publication of research, technical guidance, and the like do not come under this limitation.) Also, ITS funds for operational tests and deployment projects must be used primarily for the development of ITS infrastructure, and not, to the maximum extent possible, the construction of physical highway and transit infrastructure.

Last, those applying for ITS funds must to submit an analysis of the life-cycle costs of operations and maintenance, if capital costs exceed $3 million, and a multi-year financing and operations plan.

Definitions (Section 5211)

This section gives applicable definitions for Commercial Vehicle Information Systems and Networks, Commercial Vehicle Operations, Corridor, Intelligent Transportation Infrastructure, Intelligent Transportation System, National Architecture, Standard and a state.

Project Funding (Section 5212)

This section includes the three earmarks for the Hazardous Materials Monitoring Systems, ITS Urban Consortium and TTI's Translink Program.

Repeal (Section 5213)

The ITS subtitle appearing in ISTEA is repealed

III. ITS "MAINSTREAMING" PROVISIONS

Throughout the new surface transportation reauthorization bill, TEA 21, several changes were made to "mainstream" the ITS program into the well-funded, traditional federal-aid highway categories. These changes mark a significant departure from ISTEA, which limited funding to the federal ITS program managed by the Federal Highway Administration. While the available funding pool has grown significantly, ITS projects and the government entities and companies behind them must now compete for this new funding with more traditional transportation programs, projects and players. The intent of these and other changes is to make ITS an "everyday" tool for state and local transportation authorities that can be supported by a variety of funding mechanisms.

What follows is a description of the several programs and provisions that, because of changes found in TEA 21, increase the available funding for ITS separate and in addition to the discrete federal program administered by the Federal Highway Administration. Copies of the referenced TEA 21 sections and related House/Senate Conference language can be found behind Tab 4

Title I Federal-Aid Highways

Federal-Aid Highways (Section 1106)

TEA 21 makes a change to the list of eligible projects for National Highway System, or NHS, funding. The NHS program is one of the four block-grant programs through which the states receive Highway Trust Fund revenues based on a complicated formula. TEA 21 provides over $28.5 billion to the states under the NHS program.

In this section, "infrastructure-based intelligent system capital improvements" are added as eligible projects for NHS funding (new item O to 23 USC section 103(b)(6)). It should also be noted that TEA 21 continues from ISTEA as eligible projects under NHS "capital and operating costs for traffic monitoring, management, and control facilities and programs" (new item H of section 103(b)(6).)

Surface Transportation Program (Section 1108)

This program, commonly known as STP, is the largest of the four highway programs of Highway Trust Fund revenues. Overall, TEA 21 provides $33 billion that may be used by states and local governments for projects on any federal-aid highway. TEA 21 changes current law -- new item 13 to 23 USC section 133(b) -- to include "infrastructure-based intelligent transportation system capital improvements" as eligible projects. As under NHS, TEA 21 continues the funding eligibility under STP

of "capital and operating costs for traffic monitoring, management, and control facilities and programs" from ISTEA (23 USC section 133(b)(8)).

Congestion Mitigation and Air Quality Improvement Program (Section 1110)

Otherwise known as CMAQ, this program will receive a 35% boost in funding over ISTEA levels to a total just over $8 billion in TEA 21. Under the National Highway System Designation Act of 1995 (P.L. 104-59), the CMAQ program was amended to include as eligible projects the establishment or operation of a traffic monitoring, management, and control facility or program if the facility or program would improve air quality (23 USC section 149(b)(4))

In addition, a new provision was included in TEA 21 whereby ITS-related projects may be eligible for CMAQ funding:

> *if the program or project improves traffic flow, including projects to improve signalization, construct high occupancy vehicle lanes, improve intersections, and implement intelligent transportation system strategies and such other projects that are eligible for assistance under [the CMAQ program] on the day before the date of enactment of this paragraph.*

(TEA 21, section 1110(b)(6).)

That is, the ITS-related project described above must have otherwise qualified for CMAQ funding any time prior to TEA 21 becoming law in order to receive such funding.

Definitions under Federal-Aid Highway Programs (Section 1201)

TEA 21 did not change the definition of "operational improvement" under the federal-aid highway capital programs, as had been proposed, to include the operation or maintenance of certain ITS systems, such as for communications systems, roadway weather information and prediction systems, and the like. As passed in ISTEA, the definition of "operational improvement" already included costs associated with capital improvements to install -- but not operate or maintain -- traffic surveillance and control equipment, computerized signal systems, motorist information systems, etc. US DOT and ITS America had advocated the expanded definition of "operational improvement" for TEA 21, but it was not included in the final bill. (Section 1201(a)(18) retains the definition from ISTEA)

However, under section 1201 a new term and definition was added for "operating costs for traffic monitoring, management, and control." In section 1201(a)(17), this term is defined as:

includ[ing] labor costs, administrative costs, costs of utilities and rent, and other costs associated with the continuous operation of traffic control, such as integrated traffic control systems, incident management programs, and traffic control centers.

How the inclusion of this new definition will affect the availability of new funding for ITS-related operating costs remains to be seen

National Corridor Planning and Development Program and Coordinated Border Infrastructure Program (Sections 1118 and 1119)

These two programs are new in TEA 21. In response to NAFTA, Congress established the National Corridors Program to help plan, design and construct economic and trade corridors of national significance in order to improve the flow of commercial traffic. Similarly, the Border Infrastructure Program is designed to improve the flow of people and goods across international borders.

Both programs are discretionary to the Federal Highway Administration with funding totaling together $700 million over six years. Although only the Border Crossing Program specifically includes ITS applications as eligible for funding, ITS America has learned that ITS-related technologies will figure prominently in both programs. Subsection 1119(b)(3) for the Border Crossing Program includes as eligible for funding: "operational improvements, including improvements to electronic data interchange and use of telecommunications to expedite cross border vehicle and cargo movement."

Innovative Surface Transportation Financing Methods (Section 1216)

Subsection (a) amends the Congestion Pricing Pilot Program, now to be called the Value Pricing Pilot Program, created under ISTEA. The most significant change is that the number of potential toll projects under this program is increased from three to 15. In addition, the program provides that vehicles with fewer than two occupants may operate in HOV lanes as part of a value pricing program.

Subtitle E Finance (Sections 1501 - 1504)

TEA 21 establishes a new innovative finance program called the "Transportation Infrastructure Finance and Innovation Act of 1998" (or TIFIA) that permits the Department of Transportation to provide financial assistance to projects in the form of direct loans, loan guarantees and lines of credit. Just about all types of transportation projects are eligible for TIFIA assistance if the project size is at least $100 million (or 50% of a state's annual apportionment of federal-aid funds). In addition, a project must have the potential to be self-supporting from user fees or other non-federal funding sources. In total some $530 million is provided in contract authority for TIFIA

Included in TIFIA is a provision lowering the minimum project size from $100 million to $30 million for ITS-related projects. (Subsection 182(a)(3)(B) of TIFIA) As the Conference Committee wrote, the rationale for reducing the minimum cost stems from the "substantial capacity enhancements attainable [from ITS] with but a limited investment."

Senator Graham (D-FL) also included a provision during Senate debate that permits up to 25% of funds under the ITS subtitle to be available for TIFIA-based loans, loan guarantees and lines of credit for projects that include "significant intelligent transportation system elements." Unfortunately, this provision failed to be included in TEA 21 as signed by President Clinton on June 9, 1998. It is, however, included in the technical corrections bill, H.R. 3978, at section 11(c).

Title III Federal Transit Administration Programs

Definitions (Section 3004)

Overall, transit programs will receive under TEA 21 some $41 billion in federal funding, of which approximately $36 billion is "guaranteed" funding behind the budgetary "firewall" created by Congress in this bill. Under section 3003, the definition of "capital project" is amended to include "transit-related intelligent transportation systems" (amending current 49 USC section 5301(a)(1)(A)). This change in definition will make it possible for transit agencies and authorities to use formula and other block grant funding from the Federal Transit Administration, for the wide variety of ITS-related capital expenditures: e.g., purchases of buses equipped with ITS-related equipment, purchases of computers and software, engineering and construction, system integration, and the like. More specifically, ITS capital-related costs will be eligible under the transit formula funding program to all urbanized areas and certain rural areas (some $2.8 billion to $3.8 billion annually). Moreover, so-called "Section Three" programs for new rail starts, rail modernization and discretionary bus programs (some $2.2 billion to $3 billion annually) will now be able to fund ITS-related capital costs.

There is still the outstanding question of whether ITS-related operating and maintenance costs will be eligible for funding under TEA 21. Traditionally, the federal transit program covers operating and maintenance costs only for urban areas of less than 200,000 people; larger urban areas receive no federal funding for these expenses. TEA 21 did not clarify whether operating and maintenance costs, called "preventive maintenance" in the transit title, will now include these costs associated with ITS projects. Federal Transit Administration clarification of the coverage is needed.

Title IV Motor Carrier Safety

Information Systems (Section 4004)

Section 4004, entitled, Information Systems, was amended in TEA 21 to require US DOT to establish a motor carrier information network and data analysis capacity to collect, disseminate and analyze information regarding identification of motor carriers and drivers, vehicle registrations, license tracking and motor carrier and driver safety performance. All of these capacities are to be integrated into a national network. Funding is set at $6 million in FY98, $10 million in both FY99 and 2000, $12 million in FY2001 and 02, and $15 million in FY2003, for a total of $65 million over the six years.

III. ITS EARMARKS IN TEA 21

What follows is a list and description -- if available -- of possible ITS-related project earmarks that can be identified in TEA 21. In total, there are some 40 specific ITS-related earmarks, with total funding of approximately $200 million, that have been identified to date in the highway title, transit title, research title, ITS subtitle, or elsewhere in the bill. Moreover, there are several general research programs in TEA 21 that may involve ITS technologies. Copies of the referenced TEA 21 sections and related House/Senate Conference language can be found behind Tab 5.

Title I -- Federal-Aid Highways, Subtitle F -- High Priority Projects

High Priority Projects (Section 1602)

In section 1602 there are 1850 "high priority projects" for highways, including some 25 that appear to be ITS related. A list of the project number, state, description and total funding for the six years of TEA-21 follows (figures in millions of dollars):

Number	State	Project Description	Funding
1	Georgia	I-75 Advanced Traffic Management System in Cobb County	$1.7
74	New York	Construct interchange and connector road using ITS testbed capabilities at I-90 Exit 8	8.775
233	Dist. of Col.	Implement Geographical Information System, Washington, D.C.	7.5
321	Florida	ITS improvements on US-19 in Pasco County	1.5
437	California	Implement traffic management improvements, Grover Beach	0.375

518	Florida	Purchase and install I-275 traffic management system in Pinellas County	0.75
665	Louisiana	Construct and equip Transportation Technology and Emergency Preparedness Center in Baton Rouge	16.8
786	Louisiana	Install computer signal synchronization system in Baton Rouge	1.036
898	Maine	Implement rural ITS	0.1875
940	California	Implement City of Compton traffic signal systems improvements	3.75
992	Tennessee	Implement ITS technologies, Nashville	2.8
1089	California	Install call boxes along Highway 166 between intersection with Highway 101 and junction with Highway 33	0.216
1138	California	Upgrade and synchronize traffic lights in the Alameda Corridor East in Los Angeles County	17.25
1156	Pennsylvania	Install citywide signalization (SAMI) project in Lebanon	0.75
1223	Indiana	Install traffic signalization system in Muncie	0.675
1241	Pennsylvania	Install traffic signal upgrade in Clearfield Borough in Clearfield County	0.375
1263	Maryland	Implement city-wide signal control system replacements and improvements in Baltimore	13.275
1269	New York	Implement Melrose Commons geographic information system	0.75
1281	Michigan	Apply ITS technologies relating to traffic control, Lansing	2.775
1384	Dist. of Col.	Implement traffic signalization, freeway management and motor vehicle information systems, Washington, D.C.	6.0
1418	Oregon	Purchase and install emitters and receiving equipment to facilitate movement of emergency and transit vehicles at key arterial intersections, Portland	4.5
1457	California	Install Silicon Valley Smart Corridor project along the I-880 corridor	2.145

1477	California	Implement ITS technologies in Employment Center area of City of El Segundo	2.6625
1770	Virginia	Operate and conduct research on the "Smart Road" in Blacksburg	6.025
1840	Alabama	Conduct advance vehicle transportation research program at the University of Alabama, Tuscaloosa	2.0
Total			**$104.572**

Title III -- Federal Transit Administration Programs

Intelligent Transportation Systems Applications (Section 3012)

Section 3012 of the transit title is called "Intelligent Transportation Systems Applications." Despite this name, the earmarks under this section do not appear to include technologies normally considered ITS

Subsection (a) for Fixed Guideway Technology lists two earmarks:

(1) North Orange-South Seminole County, FL, $750,000 for FY99; and
(2) Galveston, TX fixed guideway activities, $750,000 for FY99.

Subsection (b) gives four earmarks for "bus technology," although not apparently for ITS-related technology:

(1) MBTA, MA Advanced Electric Transit Buses and Related Infrastructure, $1.5 million for each of FY99 and 2000;
(2) Palm Springs, CA Fuel Cell Buses, $1 million for each of FY99 and 2000;
(3) Gloucester, MA Intermodal Technology Center, $1.5 million for each of FY99 and 2000; and
(4) Washoe County, NV Transit Technology, $1.250 million for each of FY99 and 2000.

Subsection (c) is an earmark to the Southeastern Pennsylvania Transit Authority to develop and deploy an Advanced Propulsion Control System to be funded $2 million for FY99, $3 million for FY2000 and $3 million for FY02.

Projects for Bus and Bus-Related Facilities (Section 3031)

In section 3031 of the transit title, some 150 bus-related earmarks are listed. Of these, there appear to be six ITS-related earmarks that can been identified (figures in millions of dollars) :

Number	State	Project Description	FY99	FY2000
16	New York	Brooklyn-Staten Island Mobility Enhancement Buses	0.800	0.0
33	Minnesota	Duluth Transit Authority ITS	0.500	0.500
56	New York	Ithaca TCAT bus technology improvements	1.000	1.000
60	Michigan	Lansing CATA bus technology improvements	0.600	0.0
62	California	Livermore automatic vehicle locator	1.000	1.000
66	California	Los Angeles San Fernando Valley smart shuttle buses	0.300	0.0
Total			**4.200**	**2.500**

Title V - Transportation Research

Within the Transportation Research Title of TEA 21, there are a few earmarks concerning ITS programs. (A discussion of all ITS-related transportation research programs in TEA 21 follows below.)

Transportation Innovation and Demonstration Program (Section 5117)

Under subsection (b)(3), TEA 21 sets aside $10.2 million ($1.7 million annually) to the two largest metropolitan areas in Pennsylvania, Pittsburgh and Philadelphia, to deploy ITS infrastructure technologies to measure transportation systems activities for planning and analysis purposes. These two earmarks are part of a larger program to deploy such an ITS "measurement infrastructure" in more than 40 metropolitan areas. No other sites are specified.

Subsection (b)(6) includes an earmark for an Advanced Traffic Monitoring and Response Center shall be established in Chambersburg, Pennsylvania to develop and coordinate traffic monitoring, emergency response and ITS systems on portions of I-81 and the Pennsylvania Turnpike. Funding is available at $1.667 million annually for a total of just over $10 million

Drexel University Intelligent Infrastructure Institute (Section 5118)

Funded at a total of $10 million. Drexel University in Philadelphia, Pennsylvania shall conduct research, training, technology transfer and other ITS-related activities at a new research institute.

Earmarks in ITS Subtitle

Within the ITS subtitle (sections 5201 to 5213 of TEA 21), several earmarks for specific projects are listed. Under the metropolitan/rural deployment program (section 5208) subcategory, there are two earmarks: (1) the Gary-Chicago-Milwaukee ITS Corridor funded at $2 million per year for a total of $12 million; and (2) the I-95 Corridor funded at $5 million per year for a total of $30 million. Out of the general deployment integration funding, there are two additional earmarks: (1) Hazardous Materials Monitoring Systems and ITS at $1.5 million per year ($9 million in total); and (2) Texas Transportation Institute's Translink Research Program at $1.3 million per year ($7.8 million in total). Copies of the referenced TEA 21 language and related House/Senate Conference language immediately follows this summary.

Last, there is one earmark funded from the general research category for ITS (section 5207) to the Urban Consortium for ITS outreach and technology transfer activities, at $500,000 per year for a total of $3 million.

IV. TRANSPORTATION RESEARCH PROGRAMS

In addition to the ITS subtitle, there are several other provisions that directly or indirectly concern ITS-related research in the general transportation research title. Copies of the referenced TEA 21 sections and House/Senate Conference language can be found behind Tab 6.

Surface Transportation Research (Section 5102)

Section 5102, entitled "Surface Transportation Research," reauthorizes a general transportation research program that includes a technological innovation element. Among several priority areas, this research program, to be undertaken in colloboration with a broad spectrum of non-federal entities, shall include measuring the performance of US surface transportation systems and telecommuting and the use of information technology generally.

In addition, section 5102(d)(2)(F) includes an advanced research element that encompasses data acquisition techniques and human factors research, particularly regarding the response of travelers to new technologies.

Funding is provided in section 5001(a)(1) (which also includes funding for several other research related and technology transfer programs in this title) from $96 million to $103 million annually for a total of $592 million over six years.

Technology Deployment Initiatives and Partnerships Program (Section 5103)

Section 5103 Technology Deployment Initiatives and Partnerships Program. Under subsection (a)(2), Congress has created a very general research program that instructs US DOT to enter into partnerships with non-federal entities in order to "significantly accelerate the adoption of innovative technologies" in the areas of efficiency, safety, reliability, service life, environmental protection and sustainability.

In section 5001(a)(2), there is a separate funding authorization for this Technology Deployment Program of some $250 million over six years.

University Transportation Research (Section 5110)

Section 5110 University Transportation Research. Funded at almost $200 million over the six years (see Section 5001(a)(7)), this program establishes some 37 university transportation research centers throughout the country. Three general research areas are to be addressed: basic and applied research, education and technology transfer.

Transportation Innovation and Demonstration Program (Section 5117)

Section 5117 Transportation Innovation and Demonstration Program. There are three discrete research programs outlined in this section. First, under subsection (b)(1), US DOT shall continue a Motor Vehicle Safety Warning System research and testing program established under the National Highway System Designation Act of 1995, with funding at $700,000 annually for a total of $4.2 million.

Under subsection (b)(2), US DOT is to establish a Motor Carrier Advanced Sensor Control System program to research and deploy advanced sensors in trucks and trailers for collision avoidance, load distribution, braking system status, and the like. Again, funding is set at $700,000 annually for a total of $4.2 million.

Under subsection (b)(3), there is to be an Intelligent Transportation Infrastructure program to deploy ITS infrastructure technologies to measure transportation system activities to aid in planning and analysis of transportation systems. This program must meet the following objectives:

1. Build, operate and maintain an ITS "measurement infrastructure" in more than 40 metropolitan areas. (No more than $2 million may be spent in any one area.);
2. Provide private technology commercialization initiatives to generate revenues to be shared with the Department of Transportation;
3. Collect data primarily through wireless transmission;
4. Aggregate data into reports for planning and analysis purposes; and
5. Utilize an advanced information system designed and monitored by an experienced entity.

Initial deployment shall occur in the two largest metropolitan areas in Pennsylvania, Philadelphia and Pittsburgh. Available funding is set at $1.7 million annually for a total of $10.2 million over six years

Last, under subsection (b)(6), an Advanced Traffic Monitoring and Response Center shall be established in Chambersburg, Pennsylvania. Funding is available at $1.667 million annually for a total of just over $10 million.

Drexel University Intelligent Infrastructure Institute (Section 5118)

Funded at a total of $10 million, Drexel University in Philadelphia, Pennsylvania shall conduct research, training, technology transfer and other ITS-related activities at a new research institute.

APPENDIX B:
CEN Physical Layer Standard

EUROPEAN PRESTANDARD
PRÉNORME EUROPÉENNE
EUROPÄISCHE VORNORM

pr ENV 12253

UDC
Descriptors: ...

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English version

Road Transport and Traffic Telematics (RTTT) - Dedicated Short Range Communication (DSRC) - Physical Layer using Microwave at 5.8 GHz

Télématique du Transport et de la Circulation Routier
Communication dédiée, à courte distance
? ? ?

Telematik für Transport und Straßenverkehr
Nahbereichskommunikation Bake-Fahrzeug
Physikalische Schicht auf Basis 5,8 GHz Träger

This draft European Prestandard is submitted to CEN members for formal vote.

It has been drawn up by CEN TC278 WG9 SG.L1 and Project Team M018/PT06

CEN members shall make the ENV available at national level in an appropriate form promptly and announce its existence in the same way as for EN or HD. Existing conflicting national standards may be kept in force (in parallel with the ENV) until the final decision about the possible conversion of the ENV into an EN is reached. The lifetime of an ENV is first limited to three years. After two years the Central Secretariat shall take action by requesting members to send in comments on that ENV within six months. The comments received will be transmitted to the Technical Board for further action as follows:

- conversion into an EN after formal vote;
- or extension of the life of an ENV for another two years (once only);
- or replacement by a revised ENV approved in accordance with 7.2 and 7.3 of the CEN/CLC Internal Regulations Part 2;
- or withdrawal of the ENV;
- or assignment to a technical body of the task of assisting the Technical Board to reach any of the decisions listed above.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardisation
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

PRÉNORME EUROPÉENNE

EUROPÄISCHE VORNORM

October 1997

ICS

Descriptors: teleprocessing, road transport, traffic, traffic control, data processing, information interchange, data transmission, open systems interconnection, physical layer

English version

Road Transport and Traffic Telematics (RTTT) - Dedicated Short Range Communication (DSRC) - Physical Layer using Microwave at 5.8 GHz

Telematik für Straßenverkehr und Transport - Nahbereichskommunikation Bake-Fahrzeug - Physkalische Schicht auf Basis 5,8 GHz Träger

This European Prestandard (ENV) was approved by CEN on 7 September 1997 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. ENV 12253:1997 E

Foreword (Informative)

This European Prestandard has been prepared by Technical Committee CEN/TC 278 "Road transport and traffic telematics", the secretariat of which is held by NNI.

~~This document is currently submitted to the second Formal Vote~~According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This European Prestandard was prepared by CEN TC278 WG9, using its subgroup SG.L1 and the project team CEN/TC278/PT06 to pursue its objective which is covered by CEN Work Item 00278092.

The subject Prestandard forms a part of a series of Prestandards defining the framework for a Dedicated Short Range Communication (DSRC) link in the RTTT environment. For basic information about RTTT application requirements and the resulting concept for DSRC, please refer to the TC 278 Internal Technical Report TC278/N198 "DSRC - 1st Status Report.

In addition to this Prestandard, the following parts will also be prepared by CEN/TC278 to build a complete set of Prestandards for the DSRC link:

prENV 00278093	"DSRC Physical Layer using Infrared at 850 nm"; CEN/TC278 Work Item 00278093; document TC278/N526
prENV 00278053	"DSRC Data Link Layer: MAC and LLC"; CEN/TC278 Work Item 00278053; document TC278/N474
prENV 00278051	"DSRC Application Layer"; CEN/TC278 Work Item 00278051, document TC278/N505
prENV 278/9/#74	"DSRC Communication Profiles"; CEN/TC278 Proposed Work Item 9.3

Further standardisation activities to extend the functionality of DSRC have been initiated on request of CEN/TC 278 with the intent to define additional co-existent low data rate channels.

WG9 consists of experts mainly from telecommunication sector and also from transport sector. Most active participating companies and organisations are:

Austria:	Alcatel, Efkon, Kapsch
France:	CGA, ISIS, Renault, Thomson
Germany:	Alcatel-SEL, Bosch-Telecom (ANT), Daimler-Benz Aerospace, RWTH, Siemens
Italy:	Alenia Marconi, Autostrade, UNINFO
Netherlands:	CMG
Norway:	Micro Design
Sweden:	SAAB Combitech Traffic, Telia Research
United Kingdom:	GEC Marconi, Peek plc, STCL

Recommendations and decisions taken by CEPT, ERC, and ETSI have served as references in the preparation of this Prestandard (see Section 2 - Normative References and Annex A - Bibliography).

Additional contributions came from non-European experts via ISO/TC 204/WG 15, especially from Japan and USA. Although, conditions and regulations for DSRC implementation are different in most regions of the world, e.g. frequency / wavelength band, maximum radiated power (EIRP), requested communication mode (half-duplex, full-duplex) and others. The presented DSRC standard is applicable at least in Europe.

Document Change Control Record (Informative)

Registration by CEN/TC 278	Ver-sion	Date	Change description
N293	-	1994-08-08	Output document of project team PT06, a very important contribution for standardisation of DSRC Physical Layer (5.8 GHz).
N387	3.0	1995-02-27	First presentation of draft prENV to CEN/TC278
N473	4.0	1995-09-25	Modification of version 3.0 in accordance with comments received on N387
(this version)	5.0	1996-12-10	(1) Modification of the 'Introduction' in accordance with resolution CEN/TC278/16.11 of1996-09-26 *(in italics)*; (2) Regular update of various reference numbers (CEN work item, ETSI ...); (3) Deletion of bit rate options "below" the default bit rate (D8 / U8)

Contents (Informative)

INTRODUCTION (Informative)

Dedicated Short Range Communication is intended to be a communication means for Road Transport and Traffic Telematics (RTTT) applications, amongst others such as Automatic Fee Collection (AFC), Automatic Vehicle and Equipment Identification (AVI/AEI) and Traffic and Traveller Information (TTI).

This European Prestandard comprises requirements for Open Systems Interconnection (OSI) Layer 1 at 5.8 GHz for DSRC. The Prestandard does not include associated measurement procedures for verification of the requirements. Measurement guidelines are intended to be developed in CEN/TC278/WG9, together with ETSI RES8, as a separate work item.

The presented requirements distinguish between default and optional parameter values. Procedures for using optional parameters include considerations also of upper OSI Layers. The elaboration of such procedures will be subject to further work within CEN/TC278/WG9.

This European Prestandard caters for on-board units based on transponder as well as transceiver technologies, and allows for interoperability between systems based on both of these technologies. Furthermore, the Prestandard allows for mixed time, frequency and space division multiple access approaches.

This European Prestandard is conceived for the 10 MHz part, i.e. 5.795 to 5.805 GHz, of the ISM band at 5.8 GHz which is recommended by CEPT. It is recommended to require the exclusive use of this part of the band, considering the probability of interference caused by, or with respect to, other non-DSRC systems. An additional sub-band (5.805 - 5.815 GHz) may be allocated on a national basis for RTTT. To avoid interference impacts, transponder systems based on the backscatter principle, should be equipped with intelligent media-access control.

Resolution 16.10 taken by CEN/TC 278 on 1996-09-26:

Subject: CEN/TC 278 - DSRC Standards for 5.8GHz

CEN/TC 278, in view of the high priority accorded by industry, road operators and the European Commission to establish DSRC standards (DSRC layer 1, layer 2 and layer 7) taking account of the problems encountered in gaining consensus caused by the presence in some countries of large populations of already deployed pre-existing systems, resolves that:

1) *it reaffirms the results of the work undertaken by WG 9 and reaffirms its commitment to the draft DSRC Standards (layer 1, layer 2, layer 7) for pan European use at 5.8 GHz.*

2) *it also recognises that already established and deployed systems in large scale should be tolerated as long as they are in the public domain and can co-exist with the DSRC Standards (for layer 1, layer 2 and layer 7) and wishes to enable and encourage their migration towards full interoperability.*

3) *it recognises that on-board equipment operating according to the DSRC Standards (layer 1, 2 and 7) does not interfere with tolling systems mentioned in .2) above working in the 5.8 GHz band.*

4) *it requires that the path by which interoperability and migration is to be achieved remains the responsibility of those not using the preferred specification.*

5) *it recognises that future applications may require expansion of the available bandwidth at 5.8GHz and will do its utmost in co-operation with ETSI to persuade CEPT to expand the available bandwidth.*

1 SCOPE (Normative)

This European Prestandard . . .

- establishes a common framework for Physical Layer at 5.8 GHz for DSRC for the RTTT sector.
- provides requirements for the communication medium to be used for exchange of information between road-side units (RSU) and on-board units (OBU).
- does not include associated measurement guidelines for verification of the formulated requirements in this Prestandard.
- does not consider any one specific RTTT application, but rather caters for a communication means to be used by several applications in the RTTT sector.

The Physical Layer, at 5.8 GHz, communication requirements for the information from the RSU to the OBU are accounted for as downlink parameters, while the requirements associated with the information from the OBU to the RSU are accounted for as uplink parameters.

Physical Layer 1 requirements related to the interface to other DSRC communication layers are accounted for in 'Interface to Other Layers'.

2 NORMATIVE REFERENCES (Normative)

This European Prestandard incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and publications are listed below. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard, only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

No.	Source	Title
1	ERC	"ERC Decision of 22 October 1992 on the frequency bands to be designated for the co-ordinated introduction of Road Transport Telematics Systems"; ERC / DEC (92)02.
2	ETSI	prI-ETS 300 674 ed. 1 Radio Equipment and Systems; Road Transport and Traffic Telematics; Technical characteristics and test methods for data transmission equipment operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band

2.1 Normative Relationship with other Standards

Certain parameters in this European Prestandard and prI-ETS 300 674 are set by mutual agreement between ETSI and CEN. These parameters are identical in each standard and

cannot be changed by either ETSI or CEN without the simultaneous agreement of each of the two organisations.

3 DEFINITIONS, SYMBOLS AND ABBREVIATIONS (Normative)

3.1 Definitions for Downlink Parameters

Downlink parameters apply to transmission of data from RSU to OBU. For the purpose of this standard, the following definitions apply:

D 1 Carrier Frequencies

Number and values of the downlink carrier frequencies which are equal to the frequencies of the CW transmitted by the RSU and used by transponder OBUs for uplink communication. Each carrier frequency is the centre frequency of a downlink band.

D 1a Tolerance of Carrier Frequencies

Maximum deviation of the carrier frequency caused by any impact. It is expressed in parts per million (ppm).

Example: 1 ppm of a 5.8 GHz carrier allows for the carrier frequency to be in the range of 5.8 GHz ± 5.8 kHz.

D 2 RSU Transmitter Spectrum Mask

Maximum power (density) emitted by the RSU transmitter as function of the frequency

D 3 OBU Minimum Receiver Bandwidth

Minimum range of frequencies which has to be received by the OBU receiver.

D 4 Maximum E.I.R.P.

The maximum peak envelope power transmitted by the RSU referred to an isotropic antenna. The value is normally expressed in dBm. 0 dBm equals 1 mW.

D 4a Angular E.I.R.P. mask

Maximum E.I.R.P. as a function of the angle Θ, where Θ indicates the angle relative to a vector perpendicular to the road surface, pointing downwards

D 5 Antenna Polarisation

Locus of the tip of the vector of the electrical field strength in a plane perpendicular to the transmission vector. Examples are horizontal and vertical linear polarisation and left and right hand circular polarisation.

D 5a Cross Polarisation

Ellipticity of an antenna.

Example: If an antenna is designed to be a left hand circular antenna and it may receive (transmit) as well right hand circular waves this is a mismatch. Cross

Polar Discrimination (XPD) is measured as the ratio P_{LHC}/P_{RHC} of the power of the correct polarised wave P_{LHC} and of the wrong polarised wave P_{RHC}.

D 6 Modulation

Keying of the carrier wave by coded data. Some examples are Amplitude Shift Keying (ASK), Phase Shift Keying (PSK) and Frequency Shift Keying (FSK) and linear amplitude modulation (AM).

D 6a Modulation Index

Size of the variation of the modulation parameter (frequency, amplitude, phase) caused by the modulation signal (data signal).

D 6b Eye Pattern

Free decision distance in width and height of a digital signal. An ideal digital signal has a decision height of 100 % which is equal to the difference of high level and low level. Considering e.g. bi-phase coding, the ideal (=100%) distance in width is equal to half the bit duration.

D 7 Data Coding

Baseband signal presentation, i. e. a mapping of logical bits to physical signals. Examples are bi-phase schemes (Manchester, FM0, FM1, differential Manchester), NRZ and NRZI.

D 8 Bit Rate

Number of bits per second, independent of the data coding.

D 8a Tolerance of Bit Clock

Max. deviation of the bit clock caused by any impact, expressed in ppm or in %.

Example: 100 ppm of 500 kBit/s allows for the bit clock to be in the range of 500 kHz ± 50 Hz

D 9 Bit Error Rate (B.E.R.)

Averaged number of erroneous bits related to all transmitted bits. Used only as a reference value for layer 1. The realised B.E.R. depends on the application, and does not consider any specific distribution of errors. The effective B.E.R. within the communication zone may be different to the reference value due to time variant and stochastic impacts.

D 10 Wake-up Process for OBU

Process within the OBU which ...

(1) indicates to the OBU that it is within a communication zone, i.e. that it may now communicate with a RSU;

(2) switches the OBU main circuitry from stand by mode (sleep mode) to the active mode.

This is a feature to allow the OBU to save battery power. It is not mandatory for an OBU to use a wake-up process.

D 10a Maximum Start Time

Maximum time between the reception within the communication zone of a down-link message of minimum length, and the time when the OBU has switched to the active mode and is ready for operation.

D 11 Power Limits within Communication Zone

Minimum and maximum values of incident power referred to a 0 dB antenna in front of OBU and referred to the outside of the vehicle. These two values also specify the dynamic range of the OBU receiver. Power values are measured without any additional losses due to rain or misalignment.

D 13 Preamble

Specific Layer 1 address, independent of Layer 2. It is either only an unmodulated carrier wave or a modulated carrier, in which case the requirement refers to the channel after coding.

D 13a Preamble Length

Length of the preamble measured in number of bits.

D 13b Preamble Wave form

Signal shape of the preamble as it is on the channel.

3.2 Definitions for Uplink Parameters

Uplink parameters apply to transmission of data from OBU to RSU. For the purpose of this standard, the following definitions apply:

U 1 Sub-carrier Frequencies

Number and values of the uplink sub-carrier frequencies, i.e. the frequency distance of the centre of the uplink band to the corresponding downlink carrier, i.e. to the centre of the corresponding downlink band.

U 1a Tolerance of Sub-carrier Frequencies

Maximum deviation of the sub-carrier frequency caused by any impact. Normally it is expressed in % or in parts per million (ppm) of the sub-carrier frequency.

Example: 1 % of 1.5 MHz sub-carrier allows for the sub-carrier frequency to be in the range of 1.5 MHz ± 15 kHz.

U 1b Use of Side Bands

Specification of the use of the uplink sidebands. Data can be modulated on only the upper side band or on both side bands. As an option, different data can be modulated on the two side band.

U 1c Tolerance of Direct Generated Uplink Carrier

Maximum relative deviation of the uplink carrier in case it is generated directly within a (transceiver type) OBU. Refer to U1a and D1a.